OHIO WOOD WASTE MARKETS AND RESOURCE(S) STUDY

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Prepared For:

CONSTRUCTION AND DEMOLITION ASSOCIATION OF OHIO

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OhioEPA
Ohio Environmental Protection Agency

OHIO DEPARTMENT OF NATURAL RESOURCES

About The Study/Grant

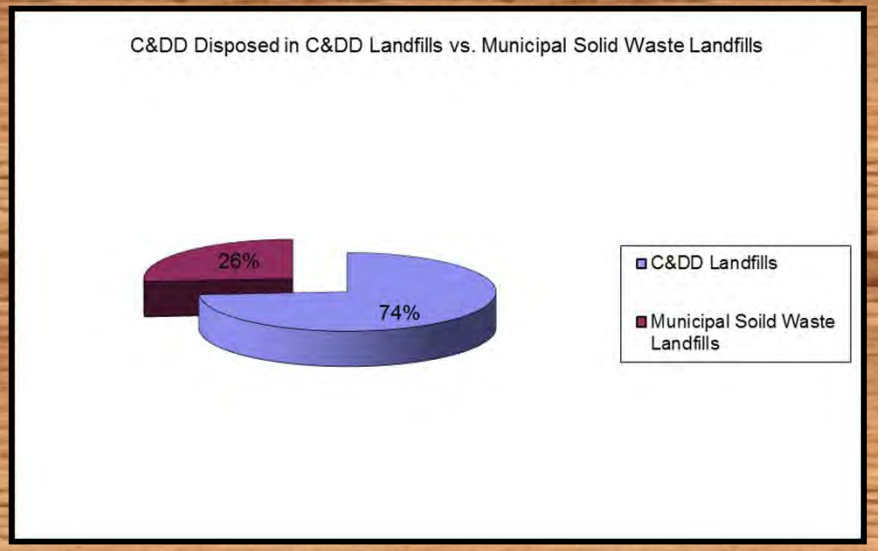
- Granted by ODNR to the Construction and Demolition Association of Ohio [CDAO]
- Purpose was to…
  - Identify readily available wood waste sectors
    - Construction and demolition landfills and recyclers
    - Forestry residues
    - Material recovery facilities
    - Compost facilities
    - Other sources
  - Identify/quantify what is currently readily available
  - Identify general economics
  - Perform a limited waste sort to confirm similar studies
  - Make conclusions and observations regarding the overall findings

Participants

- Ohio Department of Natural Resources
- Ohio Environmental Protection Agency
- Ohio Forestry Association
- Construction Materials Recycling Association
- Construction and Demolition Association of Ohio
- Landfills and Recyclers
- Public Utilities Commission
- The Ohio State University
- West Virginia University [Appalachian Hardwood Center]
- Multiple non-profit trade associations
- Private and pubic sector interested parties, organizations and utilities

C&DD Disposal

- According to State supplied data, approximately 4,739,480 tons of C&DD was disposed 2011.
- The total amount of tonnage disposed at licensed C&DD landfills was 3,495,085 tons in 2011.
- There was approximately 1,244,402 tons of C&DD reported to be disposed of at 35 MSW landfills.



Waste Sort on C&DD

- GSE was tasked to develop a scope and subsequently perform a limited "Construction and Demolition Debris Waste Characterization Study" with a focus on wood content. GSE and CDAO, performed waste observation and estimation activities at three C&DD sites. The sites were located in the following areas:
  - Metropolitan
  - Suburban, and
  - Rural
- Waste sort was designed to confirm "long term" studies performed elsewhere in an effort to substantiate similarities without significant cost.

Historical Studies for Wood Content

Region/Source	Percent Total Wood	Year Data Published
Massachusetts	46.6 %	2004
Massachusetts	31.5 %	2008
Wisconsin	26.3 %	2003
Delaware	30.1 %	2006-07
California	19.9 %	2006
King County, WA	45.3 %	2002
Ohio	34.0 %	2004
Averaged Total	33.4 %	

National Findings on Wood Concentrations Within C&DD Waste

- Highly urbanized areas may use more masonry materials
- The general economy (new home construction rates)
- Disaster and storm debris
- Seasonality
- Urban renewal (increased demolition)
- Geographical areas within the country may use different building materials.

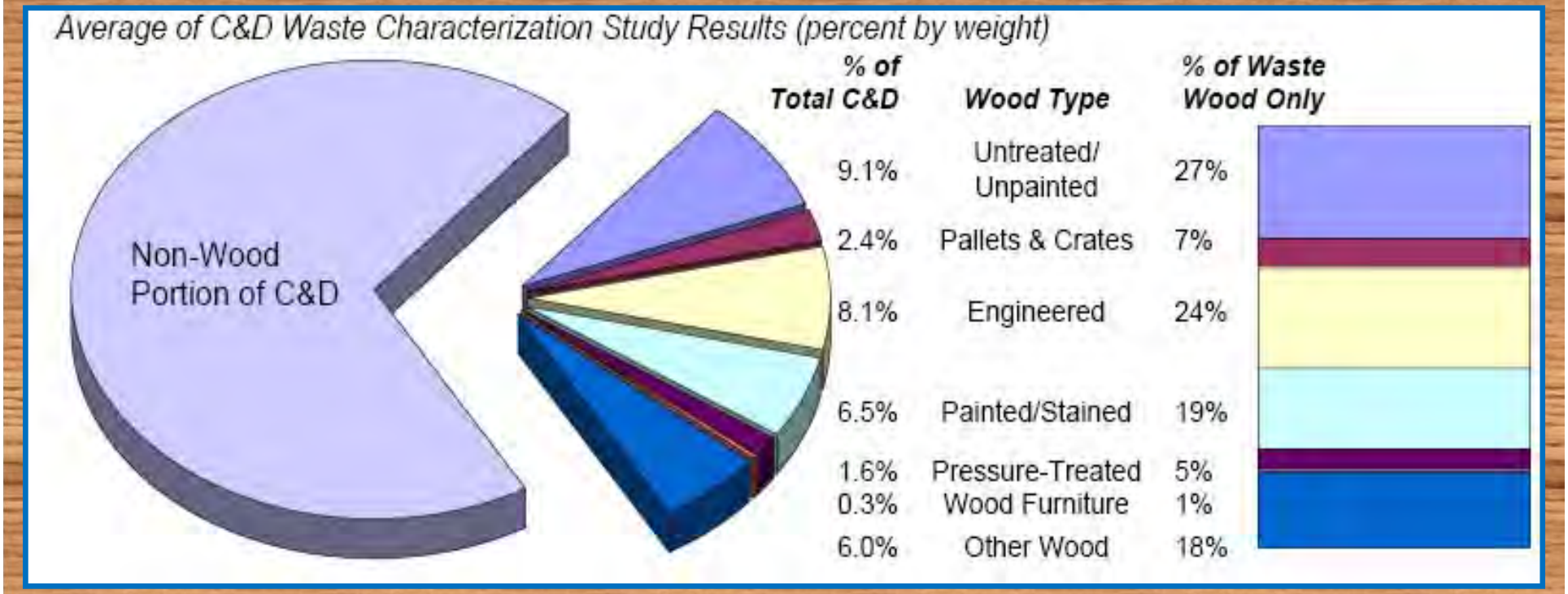
Ohio Initial Findings

- Facilities had between 22% and 50% wood by volume or between 10% and 32% by weight.
- “Extractable wood is approximately 50% if using mechanized processing methodologies.
- Natural disaster events [e.g. hail storms and tornadoes] create a disproportionately high percentage of asphalt shingles when compared to national averages.
- When natural disaster debris was factored out, wood within Ohio’s C&DD averaged between 23% and 32% by weight.

Ratio of C&DD to Wood

- With 4,739,480 tons of C&DD disposed, the wood fraction could be upwards of 1,318,931 tons of wood [based on 32.4% wood]. Extractable wood, based on 50% extraction would be approximately 659,465 tons.
- Extractable wood is much lower today based on limited processing [markets for this wood will drive processing]
- Most wood [clean] extracted from C&DD used in the decorative mulch market.

What's in the Wood



Source: **DSM Environmental Services Inc.**

GSE identified approximately 50% of the wood to be "clean", 20% to be OSB and plywood and 30% to be treated, painted and/or engineered during the Ohio limited waste sort.

Other Commodities

	Asphalt Roofing (volume/weight)	Aggregate (volume/weight)	Cardboard (volume/weight)	Metals (volume/weight)
Facility A	23.3% - 45.1%	9.0% - 25.3%	7.5% - 1.6%	>1.1% - >1.1%
Facility B	50.4% - 82.3%	<1.0% - <1.2%	4.9% - 0.8%	>1.0% - >1.7%
Facility C *	<12% - <10%	9.6% - 27.9%	2.2% - <1.0%	

******Asphalt shingle generation is not specifically tracked by facility. Asphalt shingles generally ends up within fines and rubble materials*

- Based on national averages, asphalt shingles could make up between 5% to greater than 20% of the waste stream.
- Facility A & B were observed to have significantly more asphalt singles than the national average.
- If the statewide of asphalt shingle generation rate was 12% shingles of the 4,739,480 tons of C&DD disposed, asphalt shingle disposal could be at least 568,737 tons.
- If shingle disposal was 24% by weight is would be we upwards of 1,137,475 currently being disposed.

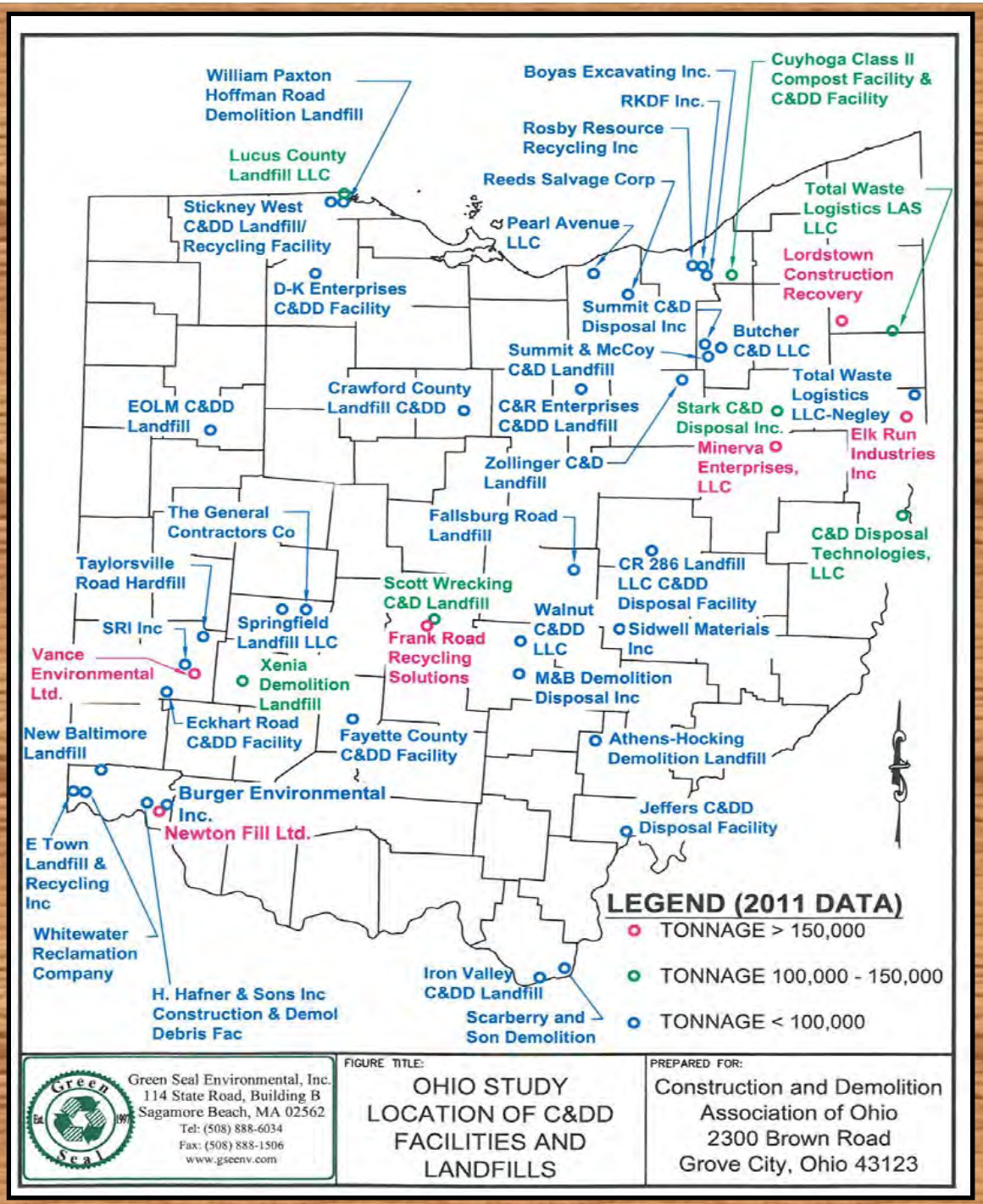
National Studies

Characterization of C&D Waste - Literature Review and DSM Data (percent by weight)

Study:	DSWA	Wisconsin	California	King Cty, WA	Ottawa
Year:	(2006 - 07)	(2003)	(2005)	(2002)	(2005)
	(%)	(%)	(%)	(%)	(%)
Concrete (and mixed rubble)	11.7	12.1	10.8	2.3	9
Wood	30.1	26.3	20.2	45.3	26
Drywall		4.1			10
Clean drywall	9.8		4.5	2.6	
(1)	3.6	4.5			
Roofing	15.3	22.1		11	
Asphalt roofing	(2)	(2)	4.4		12
Metals	2.9	3.9	4	10.9	9
Bricks	(3)	(3)	(3)	(3)	3
Plastics	1.6		0.8	3.1	

1. Painted /demo drywall included in mixed C&D residues and not separately counted
2. Asphalt roofing included in Roofing
3. Included in concrete

Disposal At C&DD Landfills



Composting Facilities

- 4 types within the state [Class I through IV]
- Over 745,000 tons handled in 2010.
- Ten largest facilities accept almost 50% of the yard waste.
- Significant infrastructure in place already and market is strong for mulch and wood products [values vary between $30 and $50 per ton].
- Likely not a source as a raw material for new industries [e.g. Manufacturing or fuel].

Forestry Waste & Residues

- Forestry waste is generally placed into 3 categories:
  - ***Forest Residues:*** Includes logging residues, rough rotten salvageable wood, and excess small pole trees and material resulting from forest management operations [i.e. sawdust, tops, etc.].
  - ***Primary Mill Residues:*** Residues generated from manufacturers who use whole round logs to produce lumber and panel products. Residues can include chips, edging, sawdust, bark, trimmings, etc.
  - ***Secondary Mill Residues:*** Residues generated from manufacturing wood products such as cabinets, millwork, furniture, pallets, and paper manufacturers.

Data Collection

- Relied on the following primary contributors
  - Ohio Forestry Association
  - Ohio University
  - The Ohio State University [including the Forest Operations and Products Extension]
  - West Virginia University [Appalachian Hardwood Center]
  - Historical Public Utilities Commission of Ohio & Ohio Division of Forestry reports

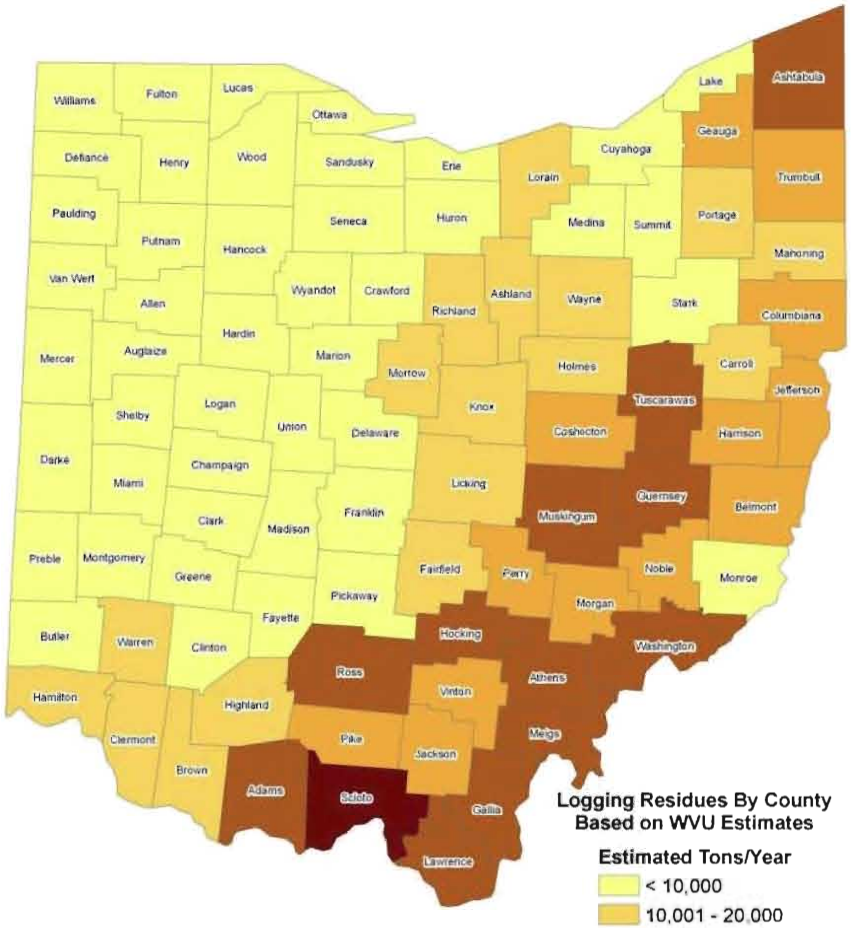
Most Recent Data

- Appalachian Hardwood Center compiled many fact from several previous studies.
  - Forest and mill residue [primary and secondary)]generated in Ohio is between 1.7M and 2.1M annually
  - Between 58% and 98% of these residues are already utilized [based on reporting year].
  - Based on 2009 data, mill residues equate to 396,036 that is potentially “available” [economically driven]
  - If forestry residue has the same available percentage, approximately 400,000 tons could be “available”.

Most Recent Data, continued

- Consumers of forestry and/or mill residues generally pay between $18 and $28 per ton [generally the biomass industry].
- When the price drops for forestry residues, foresters leave the material in place and do not take it to market.
- Specialty residues [e.g. decorative mulch] may yield significantly higher pricing.
- There are no recent surveys such as collecting data from forest product manufacturers and surrounding states, which may yield better quantitative data.
- Further studies for will be available soon from West Virginia University [Appalachian Hardwood Center] at http://ahc.caf.wvu.edu/joomla/

Total tons based on calculated harvest and 8 tons/acre avg (1,201,610 tons)



Total Estimated Logging Residue = 1,201,610 Tons

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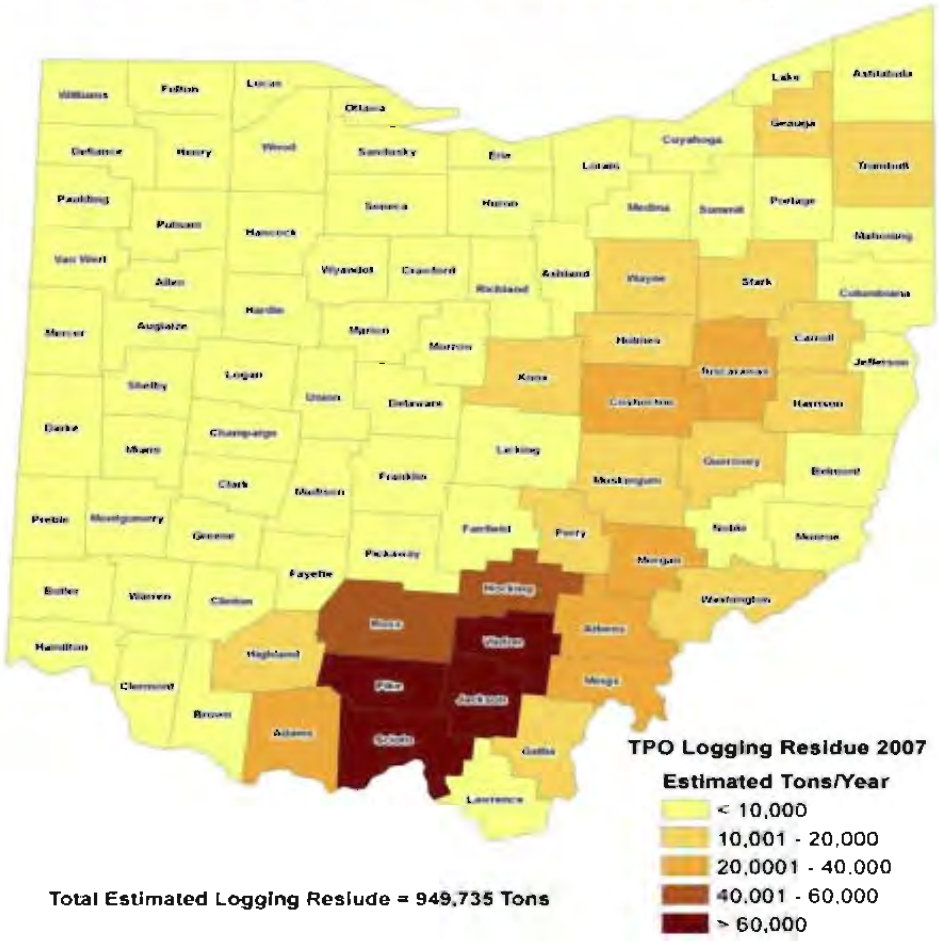
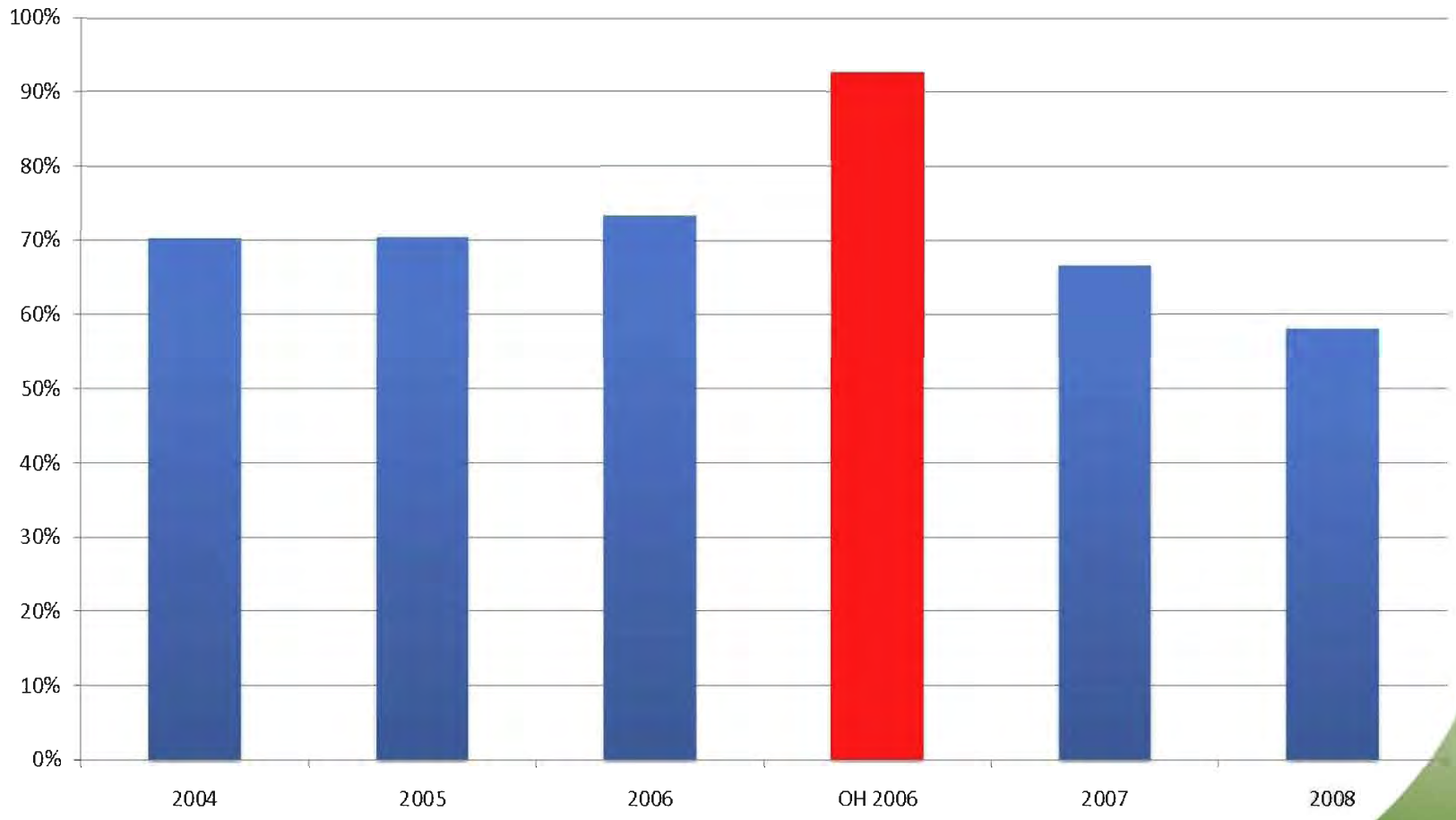
Total tons of logging residue in OH – TPO 2007 (949,735 Tons)



Total tons is considerably lower – what is the estimated tons/acre based on TPO?

Utilization of mill residues



Ohio data source – USDA TPO 2007, Wiedenbeck and Sabula 2006

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Available Quantities Wood

- There is likely several million tons of unused biomass/wood generated within the state of Ohio.
- A significant portion of the unused wood is being disposed of at C&DD and MSW landfills.
- Based on current economics and/or lack of “need”, greater than 40% of the mill residues that are generated are not currently being reused [2009 data].
- Out of the approximate 0.9 to 1.2M tons of forestry residues generated [dependent upon the approach used to calculate the amount of waste generated], it appears that there could still be a significant amount of residue still “available”.
- Compost facilities [or at least the materials delivered to them] are likely not a source for raw material

Ohio's Wood Consumers

- Organic products [compost and mulch]
  - Highly established market
  - Uses forestry/mill residues and limited C&DD
- Biomass energy facilities [electricity and steam] for utilities or manufacturing such as paper mills
- Other niche business
  - Pellet manufacturers
  - Pallet manufacturers
  - Pressboard manufacturers [historically]

Wood For Fuel – Does It Compare?

Material/Fuel	Btu Per Pound
Forestry Residue (wet wood)	3,500 to 4,500
Dry Wood (kiln dried lumber)	6,500 to 7,500
Coal	8,800 to 11,000
Fuel Oil	19,300
Natural Gas	1,015 (per cubic foot)

GSE conducted research on the economics of using natural gas versus wood fuel.

- Wood fuel can cost anywhere between $2.00 and $3.33 (e.g. $30 to $50 per dry ton of wood) for 1,000,000 BTUs.
- Natural gas, costs $3.58 per 1,000,000 BTU.
- When deciding to use wood fuel, other variables such as fuel handling, ash disposal, storage, procurements, etc. must be taken into consideration. http://www.eia.gov/state/state-energy-profiles-data.cfm?sid=OH

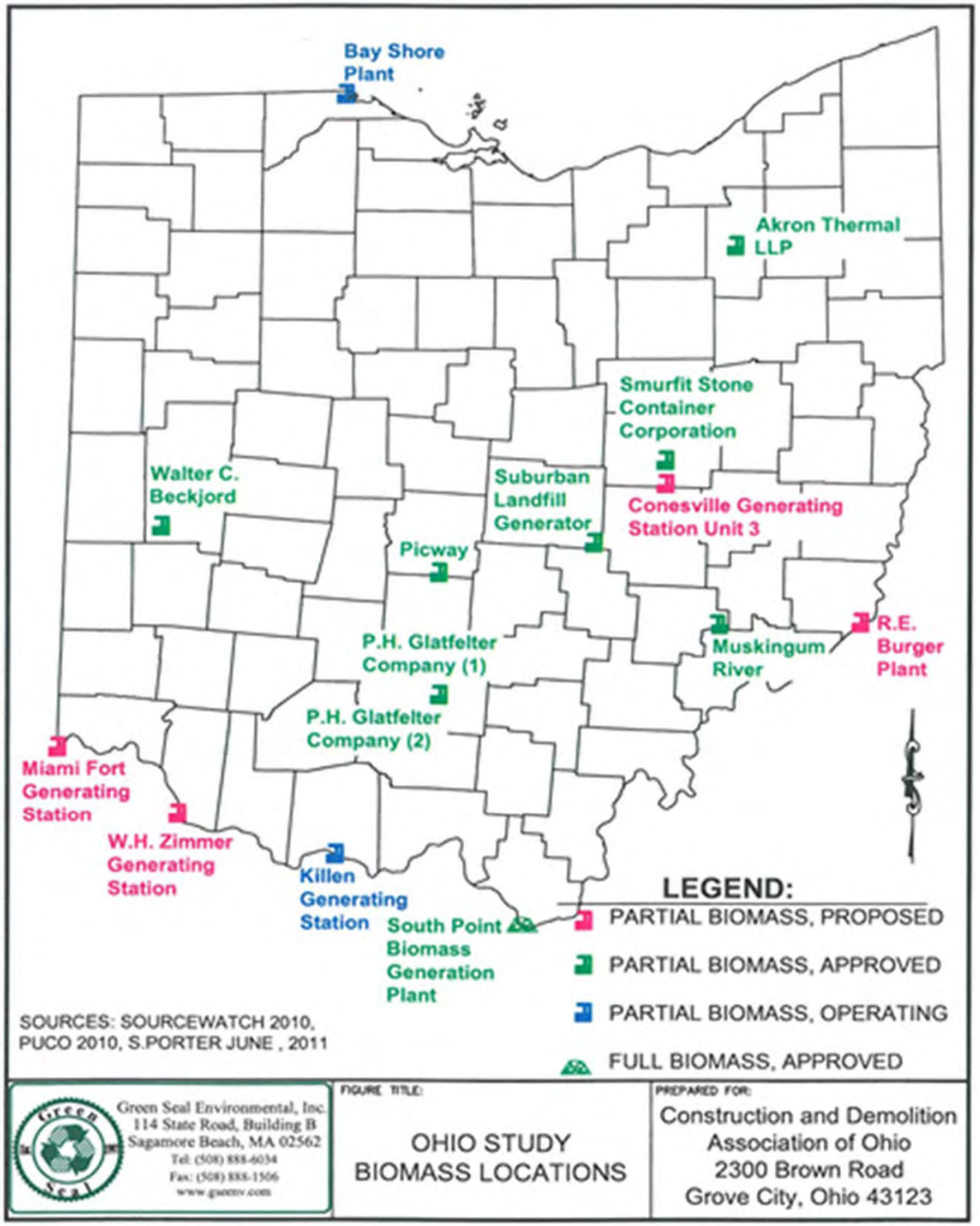
Wood Fuel Use In Ohio

- Many facilities are permitted to co-fire [e.g. supplement coal plants.
- Biomass users currently pay between $18 and $28 per ton for green waste (3,500 to 4,500 Btu per pound)
- With natural gas prices low, there has been a steady decline of biomass use (in some instances greater than a 50% reduction).
- Use is well below capacity

Who's Currently Permitted?

Plant Name	Plant Capacity (MW)	Owner	Proposed Wood Use
Killen	600 MW nameplate capacity	DP&L and Duke	U to 10% wood cellulose pellets co-fired with coal.
Conesville Generating Station Unit 3	165 MW	Columbus Southern Power Company	Proposes a test period and then unspecified level of various biomass sources.
Bay Shore Unit 1	136 MW	FirstEnergy Solutions Corp	Proposes using up to 5 % 25% wood use depending upon burner.
W.H. Zimmer Generating Station	1300 MW	Duke Energy Ohio, Inc., DP&L, AEP, Inc.	Proposes co-firing up to 10% biomass, variety of sources.
Beckjord Generating Station	1125 MW	Multiple units with Duke Energy & DP&L	Proposes co-firing up to 100% wood and agricultural biomass materials, with initial testing.
Miami Fort Generating Station Units 7 & 8	1020 MW	Duke Energy Ohio and DP&L	Proposes a variety of biomass materials up to 10%.
R.E. Burger Units 4&5	312 MW	First Energy Generation Corp.	Proposes a test phase up to 20%, then "principally biomass" 51-100% by 2013, with a variety of biomass materials.
South Point Biomass Generation Plant	200 MW	South Point Biomass Generation, LLC	100% wood waste, projected in-service date in 2012."

Biomass Proposed Geographical Locations Throughout Ohio



Is There Capacity?

- There is plenty of capacity
  - Conceptually 1.6M bone-dry tons at South Point Power.
  - Several million tons if biomass was co-fired with coal.
  - Additional capacity could be necessary at small boilers for steam and power use at pulp/paper mills

Why Isn't Biomass Used in Higher Quantities As a Fuel?

- Economics/Incentives
- There are concerns:
  - In some instances will require facilities to retrofit (e.g. sizing, storage, etc.)
  - Concerns about how post consumer wood will impact existing air permits and how QA/QC can be maintained
  - Concern about the new US EPA Boiler MACT and Cross-State Air Pollution [CASPR] Rule(s)
  - How certain wood types will impact any Renewable Energy Credits (RECs)

Other Wood Uses

- Pallet manufacturing
  - Limited usage in 2011 (53,000 tons/25% post consumer)
  - Limited C&DD use
  - Pay $15 to $21 per ton
  - Will consider more C&DD if it meets specifications
- Pellets
  - Undetermined
  - Use in other states
  - 13 Plants located in bordering states and 2 in Ohio
- Pressboard
  - No market currently.
  - Indication of historical uses
  - Tafisa in Canada uses vast quantities of post consumer wood for pressboard

Questions & Comments

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Action Items

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